CHAPTER 4

RESULTS AND DISCUSSION (PART I): PREPARATION AND CHARACTERIZATION OF RAW MATERIALS

In this chapter, the results of the investigation of raw materials on their chemical and mineral composition, particle size distribution and microstructure are presented, identified and discussed.

4.1 The chemical analysis of raw materials

The chemical analyses of raw materials used in the investigation are given in Table 4.1. The major chemical components of Hang Dong clay are silica (SiO_2), alumina (Al_2O_3), ferric oxide (Fe_2O_3), potassium oxide (K_2O), titanium dioxide (TiO_2), calcium oxide (CaO) and manganese oxide (MnO). The result indicated that the major components of charcoal are silica, potassium oxide, phosphorus pentoxide (P_2O_5), calcium oxide, magnesium oxide (MgO) and manganese oxide.

Table 4.1 Chemical composition of the raw materials used in the study.

Oxides	Hang Dong clay, wt %	Charcoal, wt %
SiO_2	48.41	87.92
Al_2O_3	24.01	<0.01
Fe_2O_3	6.25	-
CaO	0.29	0.36
K_2O	4.47	1.58
P_2O_5	-	0.80
TiO_2	1.49	-
MnO	2.33	0.17
LOI (Loss on ignition)	12.57	8.70
Total	**99.82**	**99.84**

4.2 Identification Phase by XRD

The XRD analysis of Hang Dong clay and charcoal are shown in Figure. 4.1 a and Figure. 4.2 b. The results show that the major crystalline phase found in Hang Dong clay were quartz, muscovite, kaolinite, alkali-feldspar and hematite (Figure. 4.1 a), while charcoal contained quartz and cristobalite (Figure. 4.2 b).

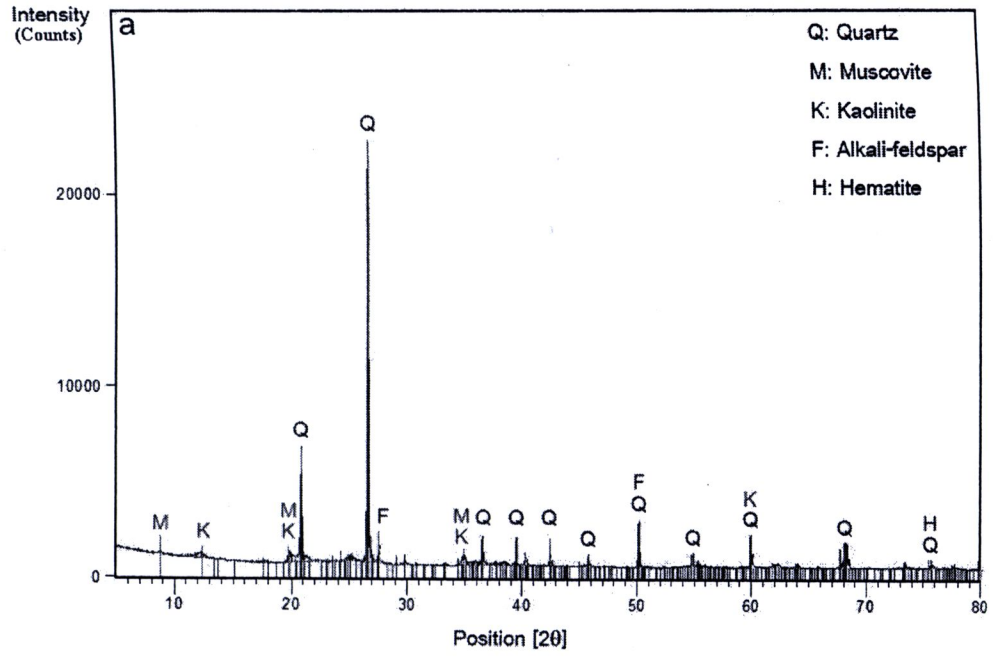

Figure. 4.1 (a) XRD diffraction pattern of Hang Dong clay.

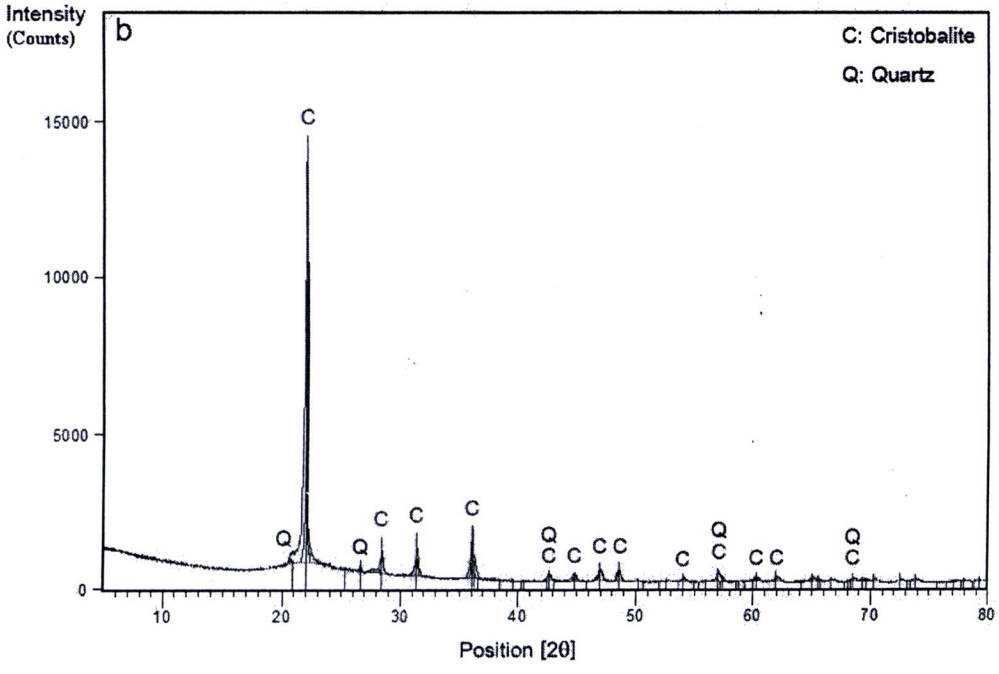

Figure. 4.2 (b) XRD diffraction pattern of charcoal.

4.3 Particle size analysis

The particle size measurement was analyzed due to identifying the size of Hang Dong clay powder before firing according to the sample composition and particle size shown in Figure. 4.3. For the particle size distribution of Hang Dong clay, the average particle size d[4,3] was 43 μm. Charcoal particle sizes were in the range of 2-3 mm. (size 1), 1-2 mm. (size 2) and less than 0.5 mm. (size 3) shown in Figure. 4.5. The different sizes of charcoal particles used as additives were obtained by dry sieving step by step through No. 35, 40 and 45 meshes, respectively.

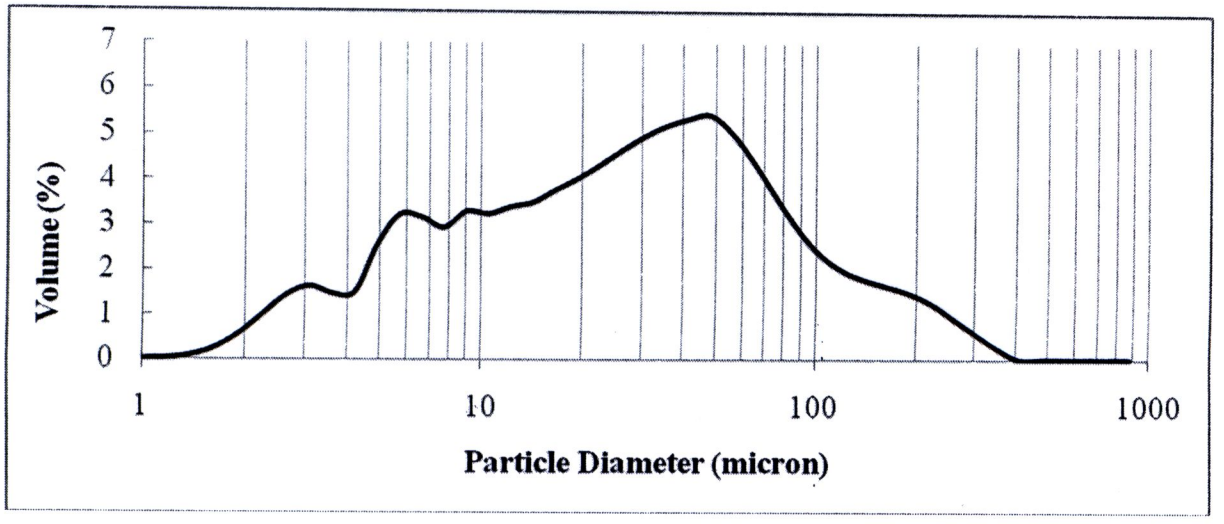

Figure. 4.3 Particle size distribution of Hang Dong clay.

4.3 The topology of raw materials (Hang Dong clay and charcoal)

According to Figures. 4.4-4.5, the scanning electron microscopy (SEM) images show that most particles of Hang Dong clay are agglomerate and coarse grain. Moreover, it is plasticity which is used for workability of manufacturing clay bricks. For charcoal, it can be seen that high porosity property in the production can be used as porosity in the clay body.

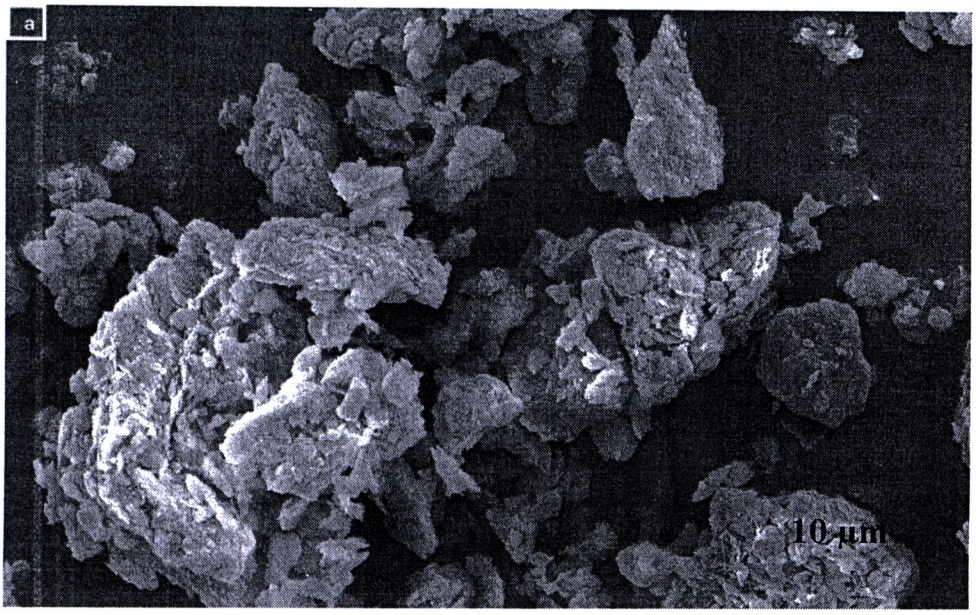

Figure. 4.4 SEM images of Hang Dong clay.

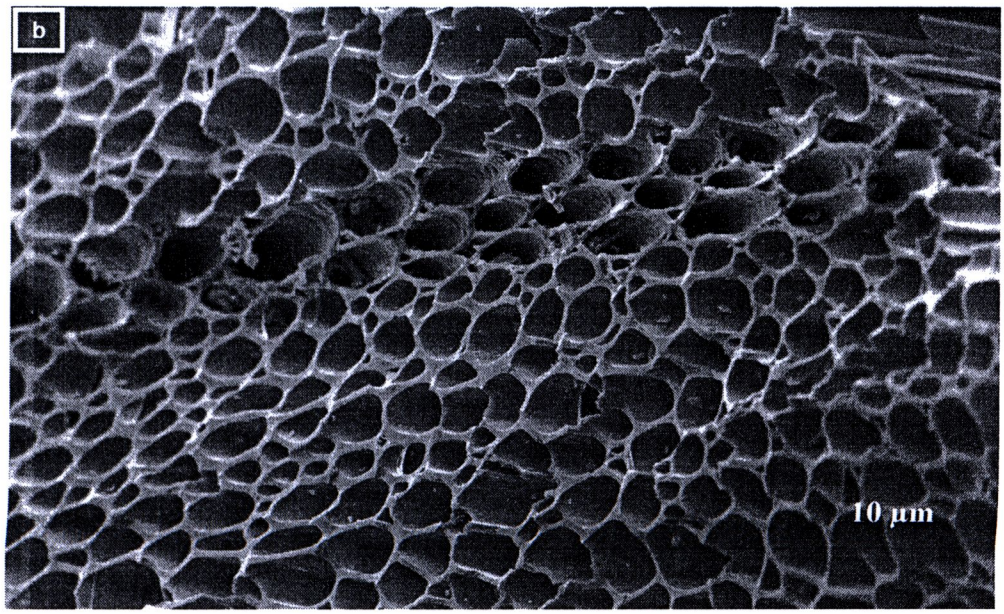

Figure. 4.5 SEM images of Charcoal.

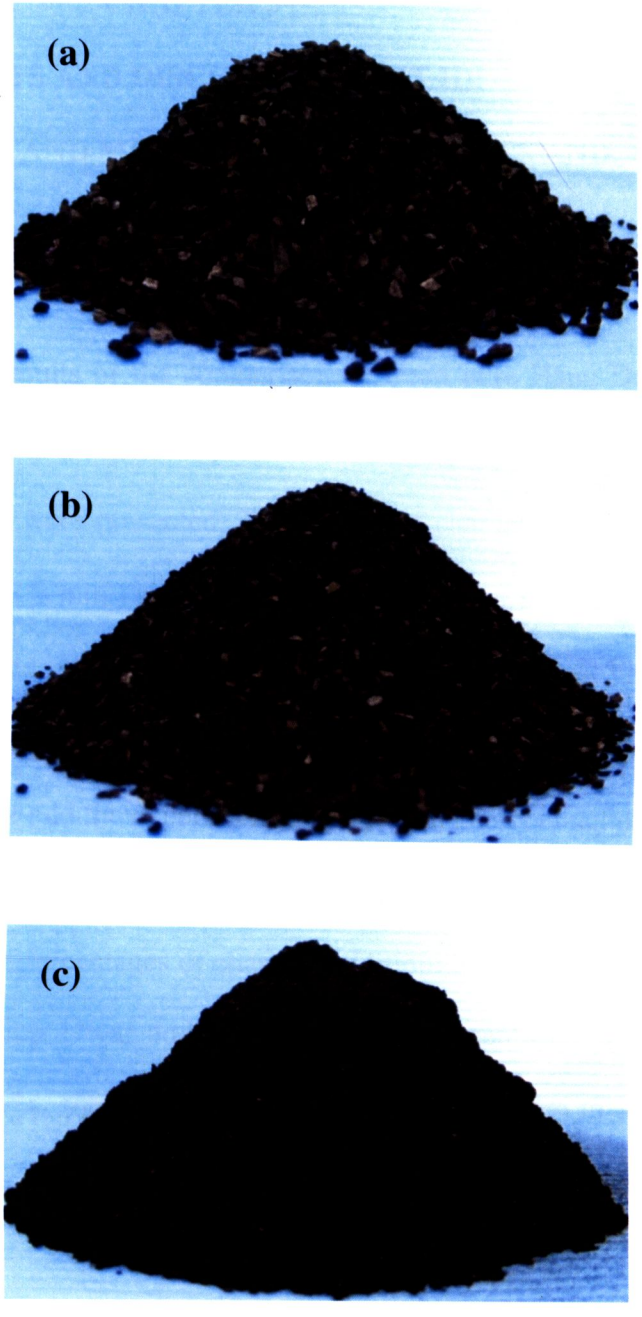

Figure. 4.6 Images of the sizes of charcoal particle ranging (a) 2-3 mm. (size 1), (b)1-2 mm. (size 2) and (c)less than 0.5 mm. (size 3).